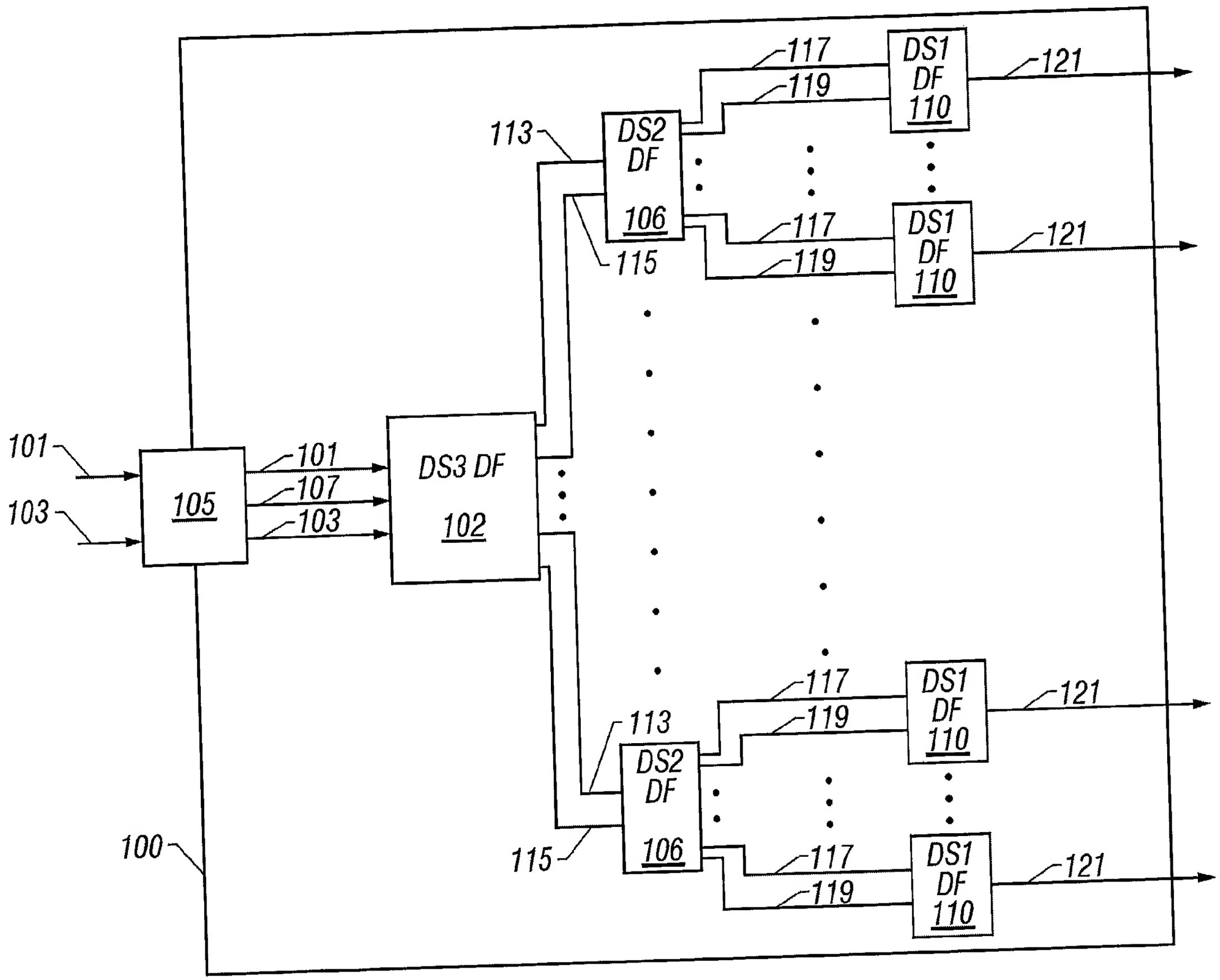

FIG. 1
(Prior Art)

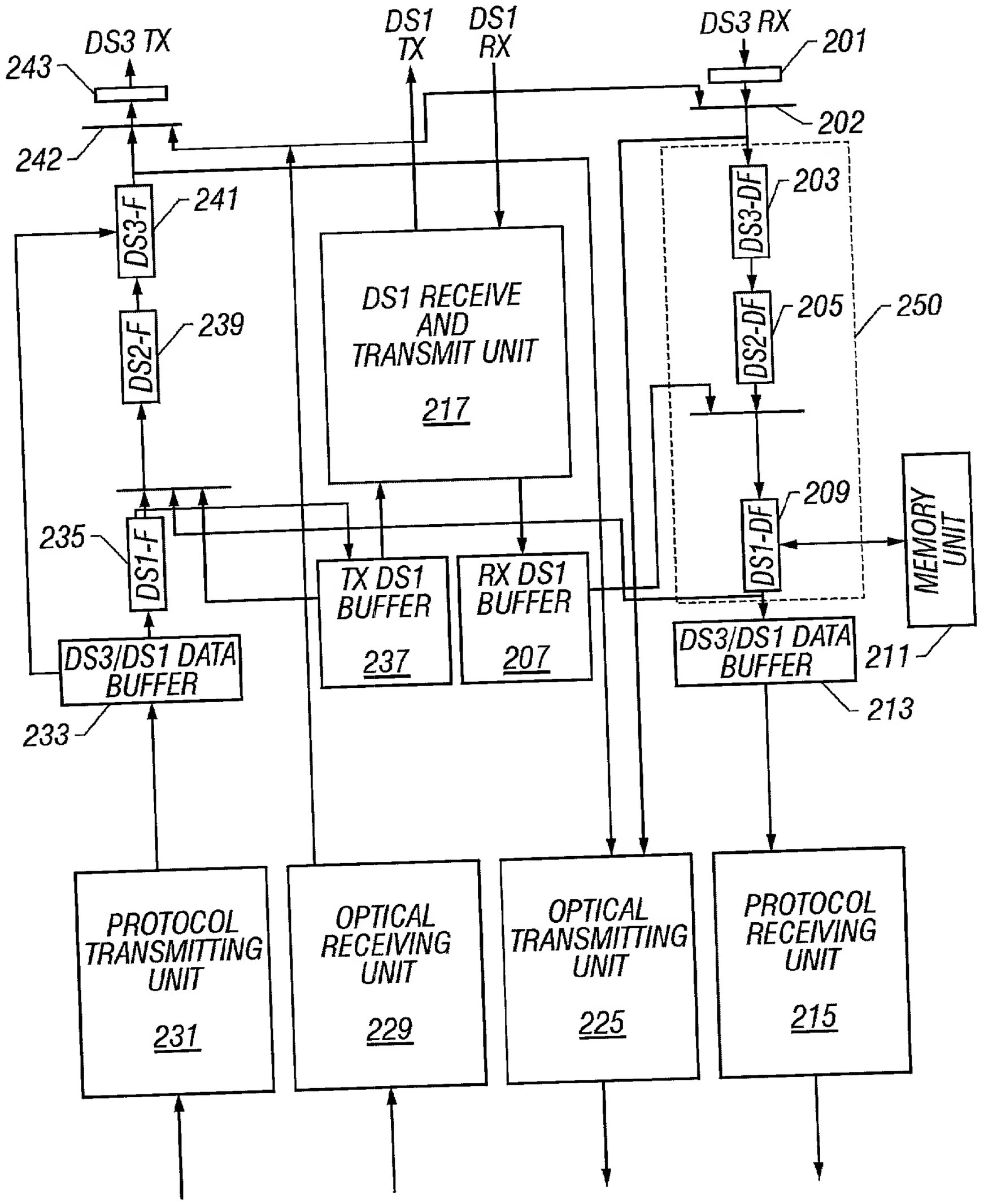
DS3 TX
243
242
DS3-F
241
DS2-F
239
DS1 TX
DS1 RX
DS1 RECEIVE AND TRANSMIT UNIT
217
DS3 RX
201
202
DS3-DF
203
DS2-DF
205
250
209
DS1-DF
MEMORY UNIT
235
DS1-F
TX DS1 BUFFER
237
RX DS1 BUFFER
207
DS3/DS1 DATA BUFFER
233
DS3/DS1 DATA BUFFER
211
213
PROTOCOL TRANSMITTING UNIT
231
OPTICAL RECEIVING UNIT
229
OPTICAL TRANSMITTING UNIT
225
PROTOCOL RECEIVING UNIT
215

FIG. 2

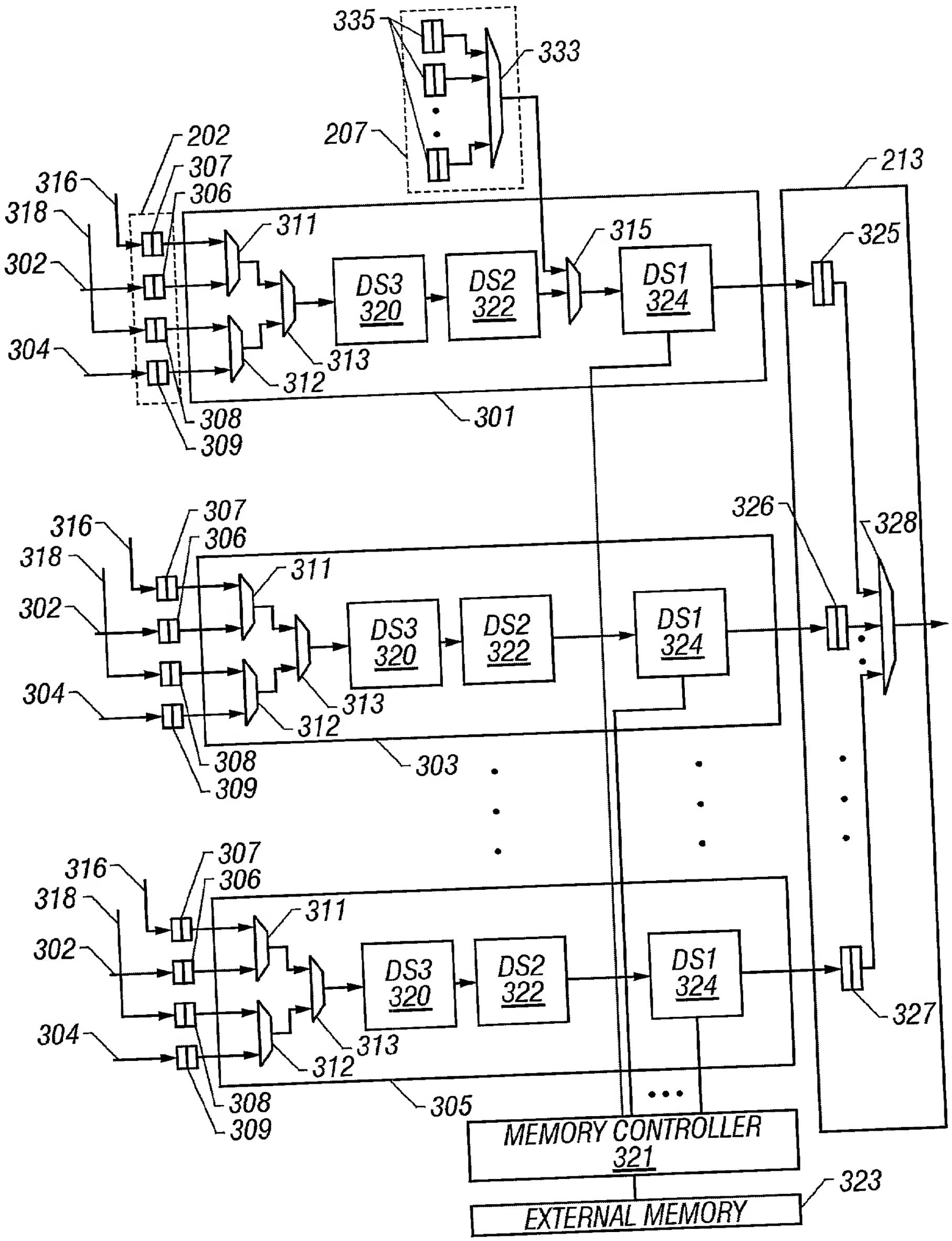
335
333
207
202
307
306
316
318
302
304
311
312
313
315
DS3
320
DS2
322
DS1
324
213
325
301
308
309
326
328
303
327
305
MEMORY CONTROLLER
321
323
EXTERNAL MEMORY

FIG. 3

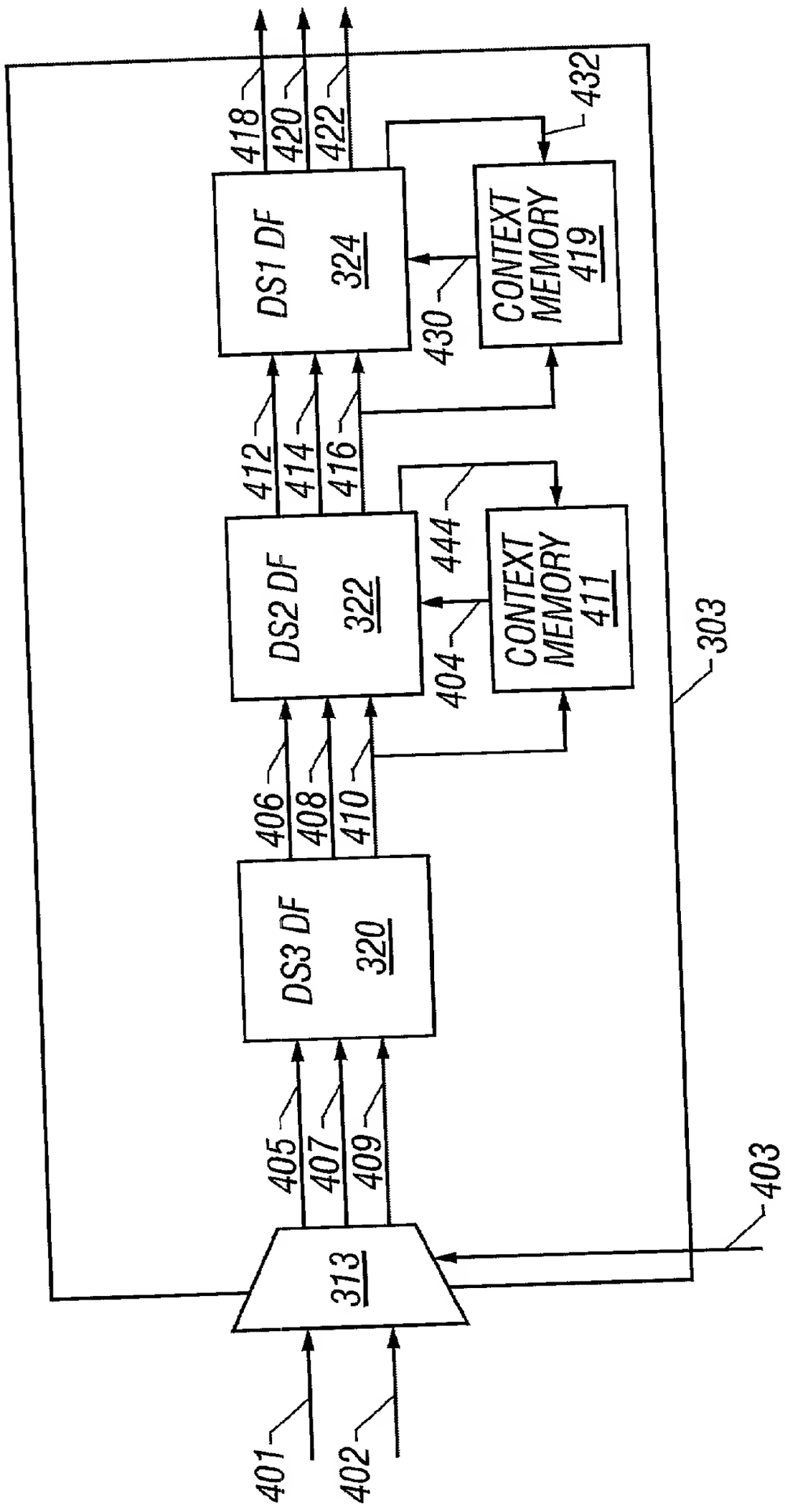
418
420
422
432
DS1 DF
324
CONTEXT
MEMORY
419
430
412
414
416
DS2 DF
322
444
404
CONTEXT
MEMORY
411
303
406
408
410
DS3 DF
320
405
407
409
403
313
401
402

FIG. 4A

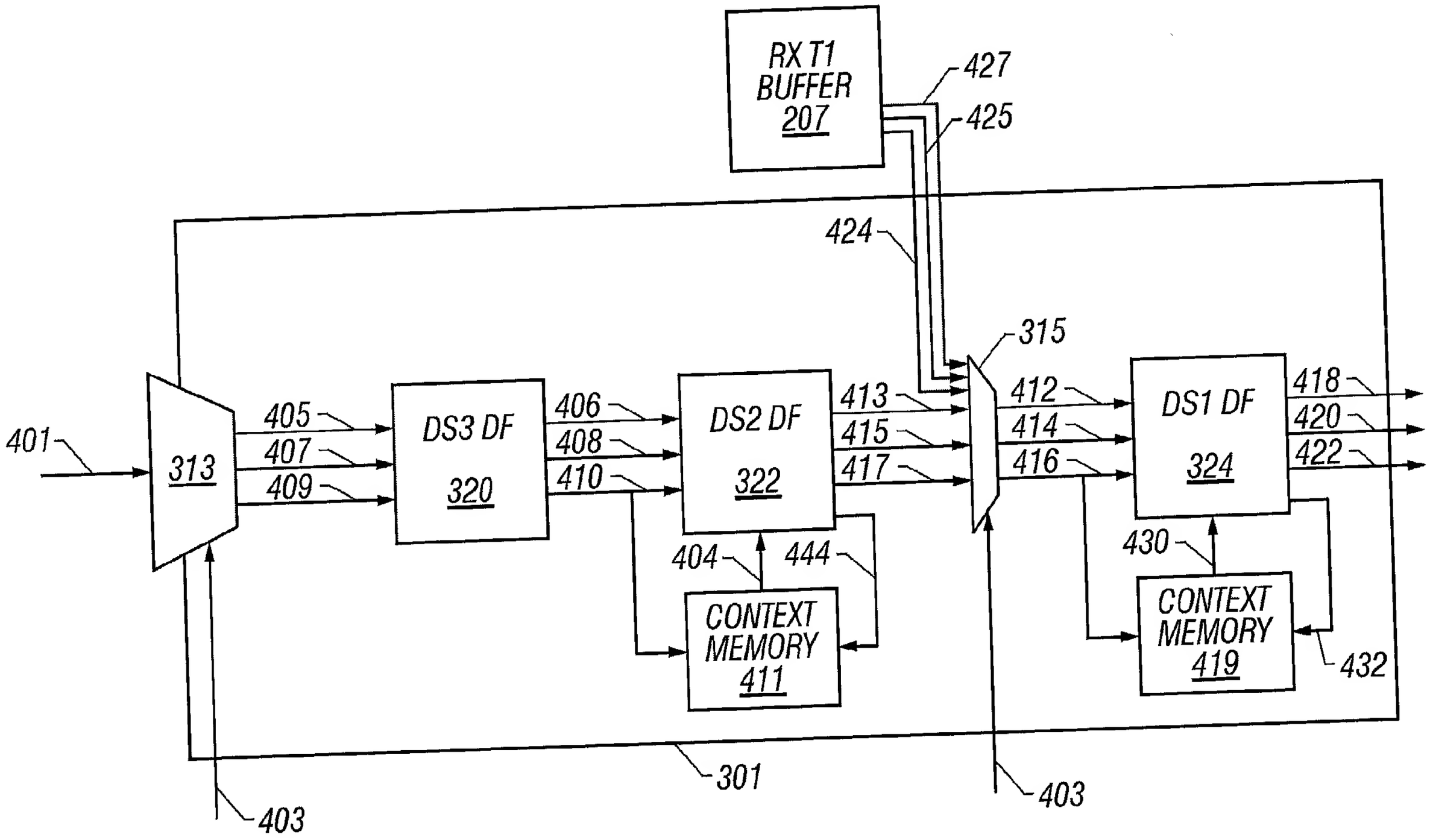
RX T1
BUFFER
207
427
425
424
315
401
313
405
407
409
DS3 DF
320
406
408
410
DS2 DF
322
413
415
417
412
414
416
DS1 DF
324
418
420
422
404
444
CONTEXT
MEMORY
411
430
CONTEXT
MEMORY
419
432
301
403
403

FIG. 4B

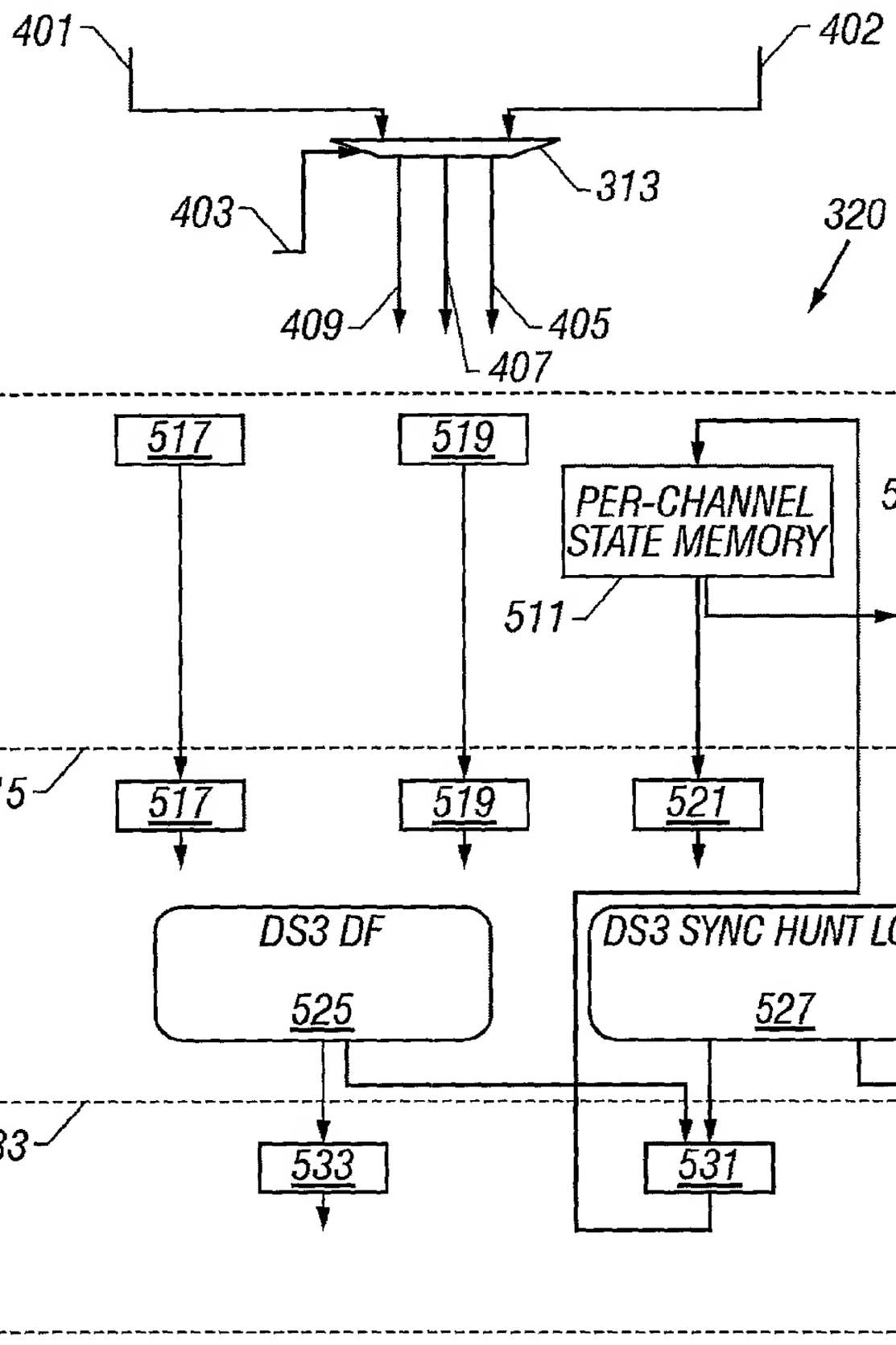
401
402
313
403
320
409
405
407
517
519
PER-CHANNEL STATE MEMORY
513
SYNC HUNT PER-ALIGNMENT MEMORY
511
515
517
519
521
523
DS3 DF
525
DS3 SYNC HUNT LOGIC
527
533
533
531
529

FIG. 5

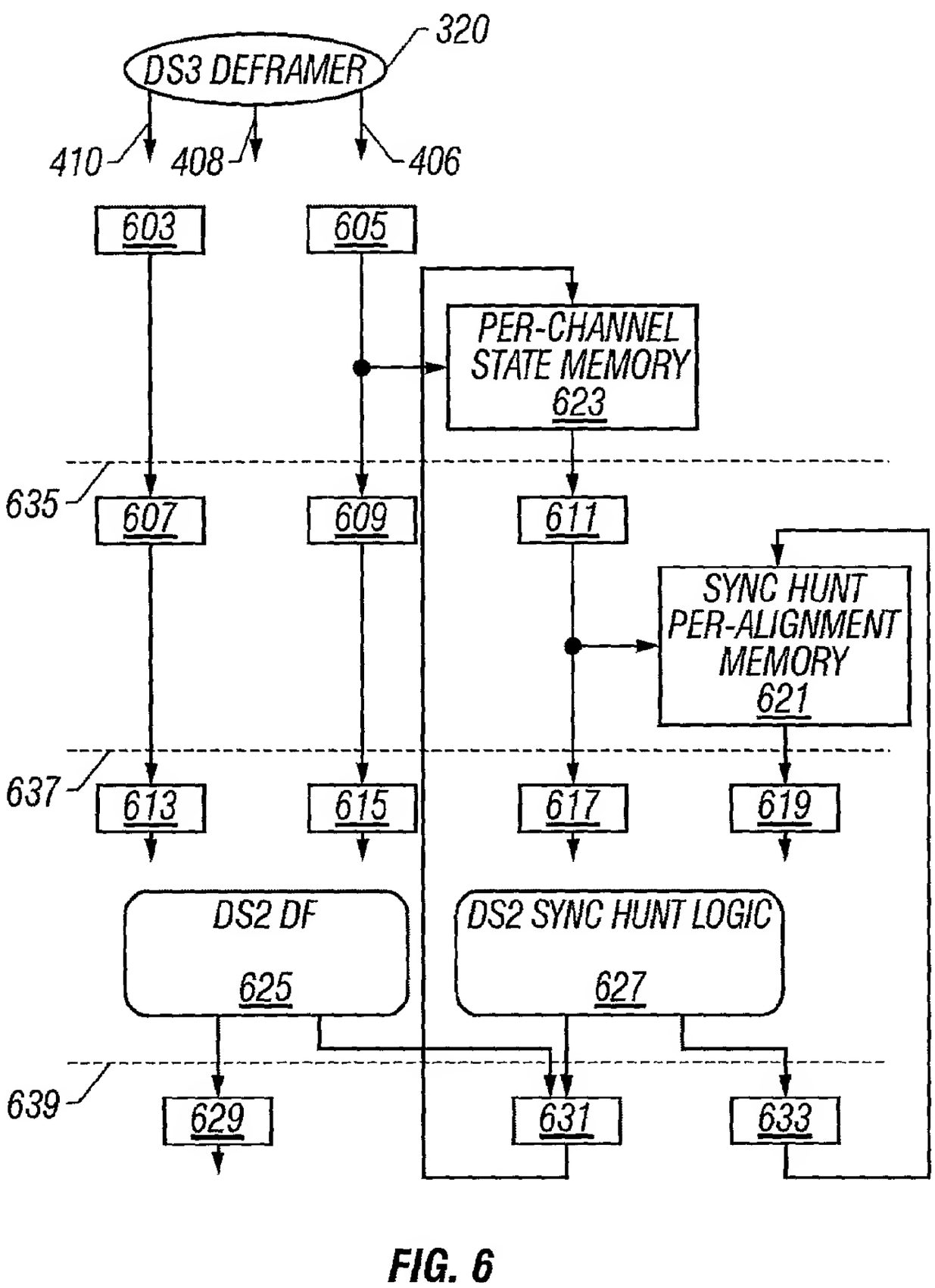
320
DS3 DEFRAMER
410
408
406
603
605
PER-CHANNEL
STATE MEMORY
623
635
607
609
611
SYNC HUNT
PER-ALIGNMENT
MEMORY
621
637
613
615
617
619
DS2 DF
625
DS2 SYNC HUNT LOGIC
627
639
629
631
633

FIG. 6

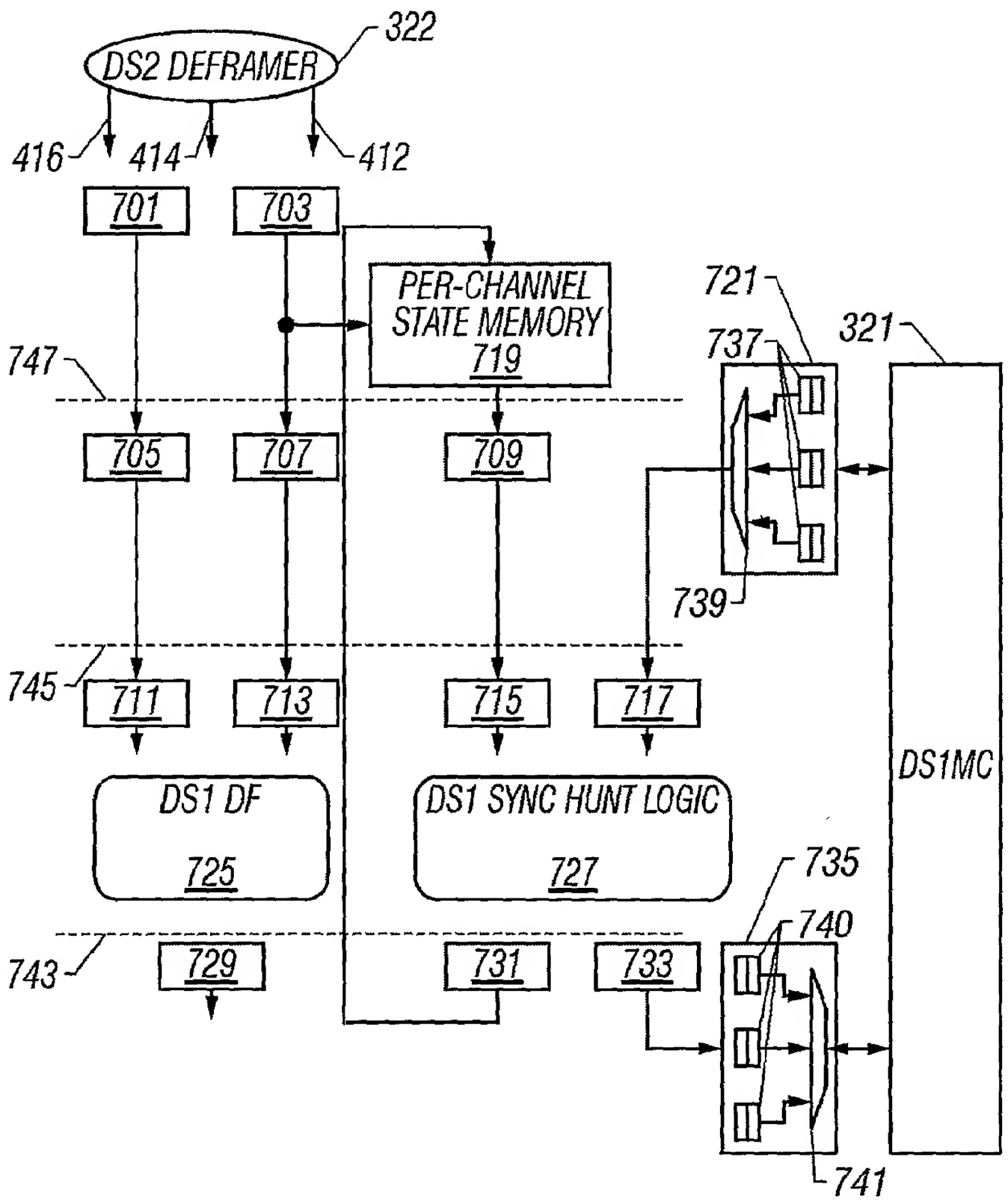
322
DS2 DEFRAMER
416
414
412
701
703
PER-CHANNEL
STATE MEMORY
719
747
705
707
709
721
737
321
739
745
711
713
715
717
DS1 DF
725
DS1 SYNC HUNT LOGIC
727
DS1MC
735
740
743
729
731
733
741

FIG. 7

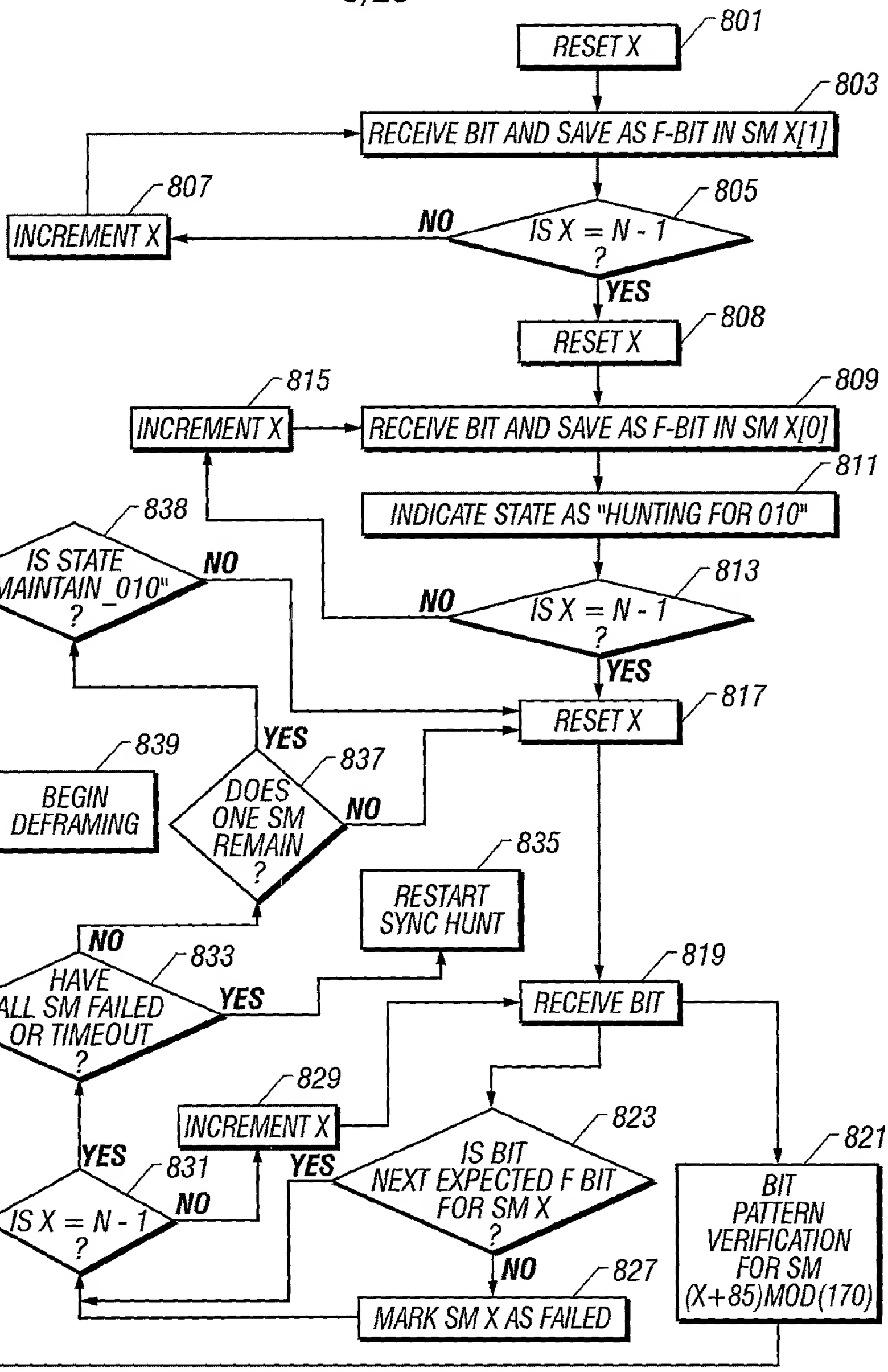
RESET X
801
RECEIVE BIT AND SAVE AS F-BIT IN SM X[1]
803
IS X = N - 1 ?
805
NO
YES
INCREMENT X
807
RESET X
808
INCREMENT X
815
RECEIVE BIT AND SAVE AS F-BIT IN SM X[0]
809
INDICATE STATE AS "HUNTING FOR 010"
811
IS X = N - 1 ?
813
NO
YES
IS STATE "MAINTAIN_010" ?
838
YES
NO
RESET X
817
BEGIN DEFRAMING
839
DOES ONE SM REMAIN ?
837
YES
NO
RESTART SYNC HUNT
835
HAVE ALL SM FAILED OR TIMEOUT ?
833
NO
YES
RECEIVE BIT
819
INCREMENT X
829
IS X = N - 1 ?
831
YES
NO
IS BIT NEXT EXPECTED F BIT FOR SM X ?
823
YES
NO
BIT PATTERN VERIFICATION FOR SM (X+85)MOD(170)
821
MARK SM X AS FAILED
827

FIG. 8A

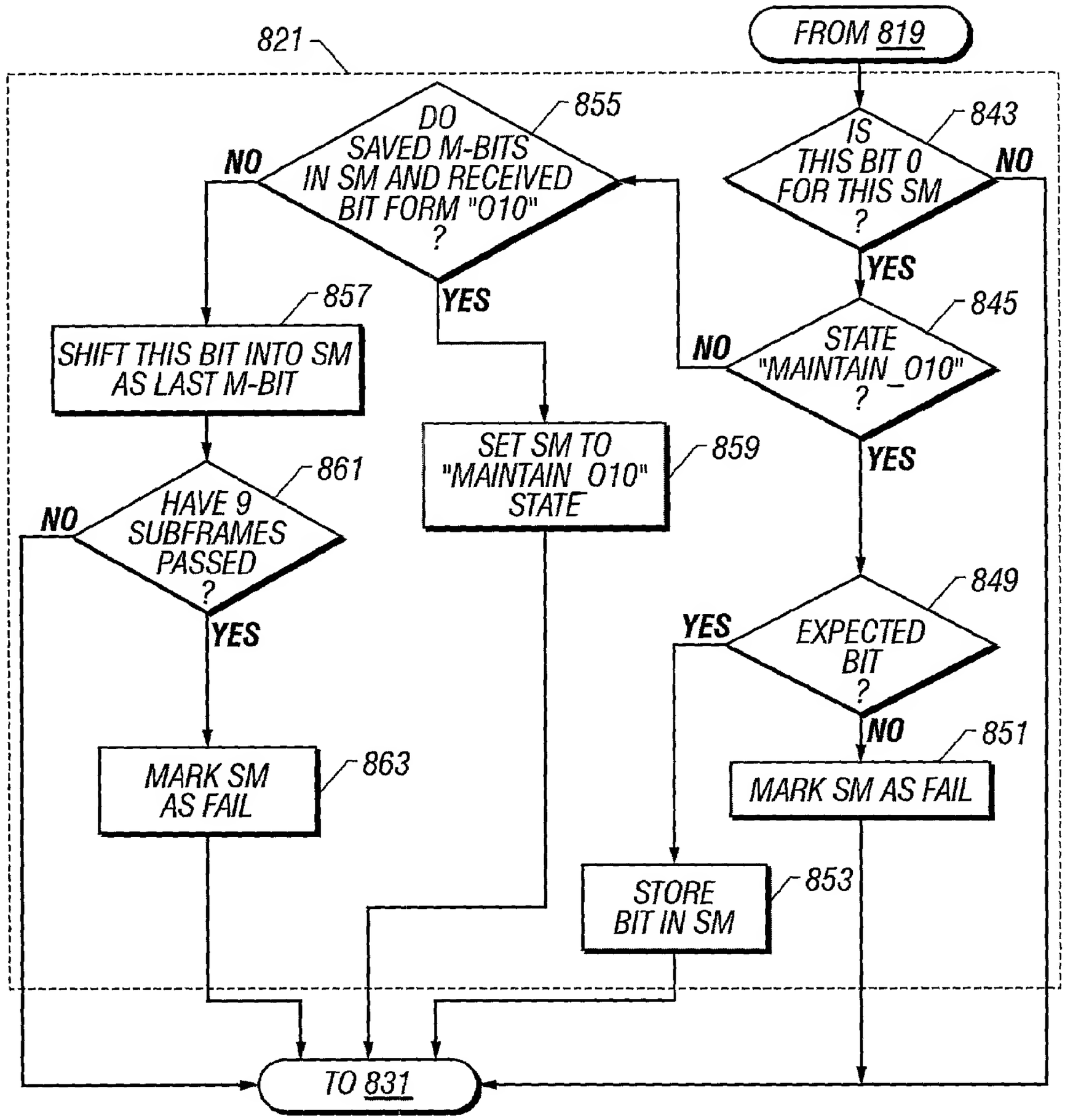
821
FROM 819
855
DO SAVED M-BITS IN SM AND RECEIVED BIT FORM "010" ?
NO
YES
857
SHIFT THIS BIT INTO SM AS LAST M-BIT
861
HAVE 9 SUBFRAMES PASSED ?
NO
YES
863
MARK SM AS FAIL
859
SET SM TO "MAINTAIN_010" STATE
843
IS THIS BIT 0 FOR THIS SM ?
NO
YES
845
STATE "MAINTAIN_010" ?
NO
YES
849
EXPECTED BIT ?
YES
NO
851
MARK SM AS FAIL
853
STORE BIT IN SM
TO 831

FIG. 8B

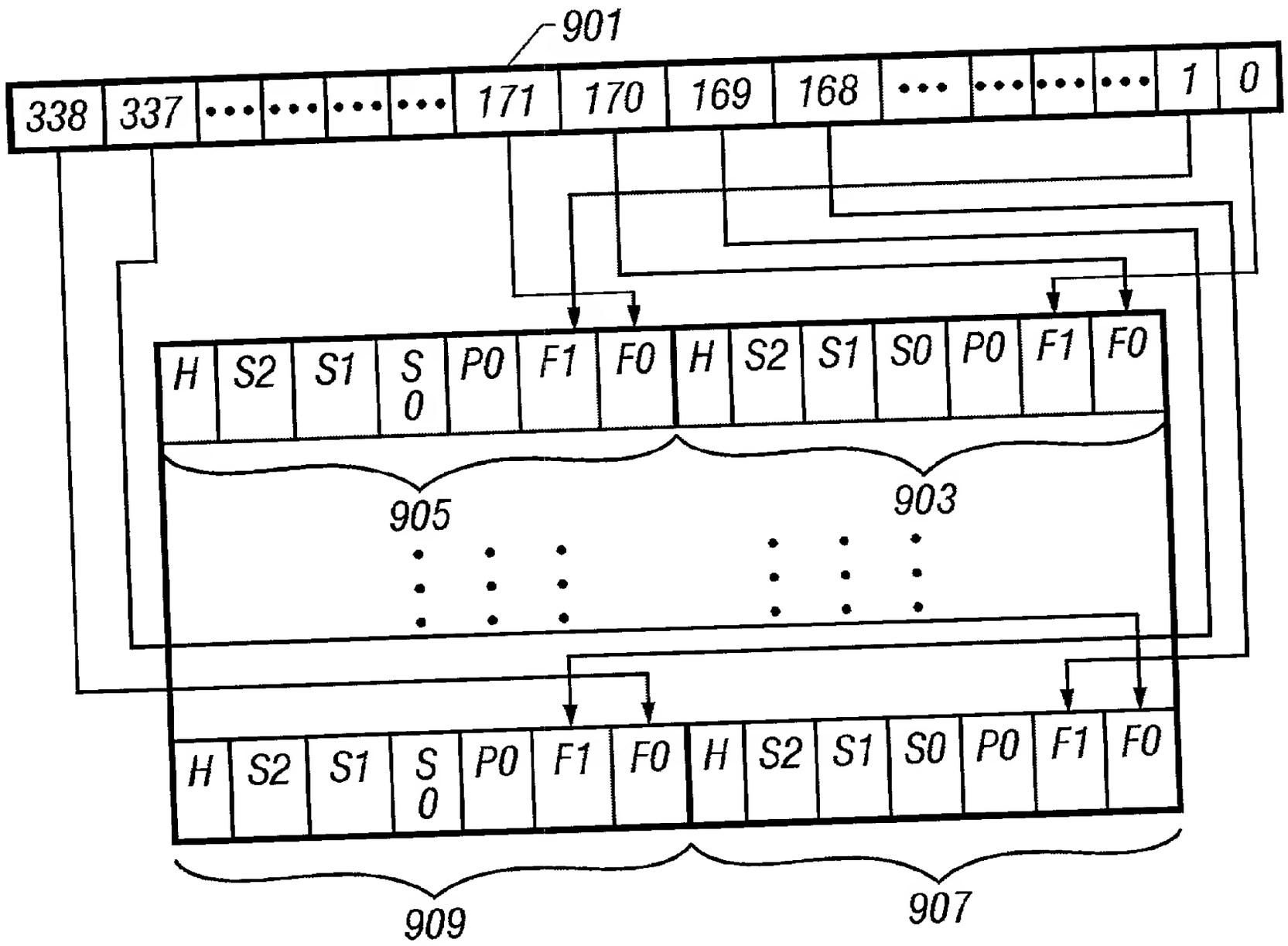
901
338
337
171
170
169
168
1
0
H
S2
S1
S 0
P0
F1
F0
905
903
909
907

FIG. 9

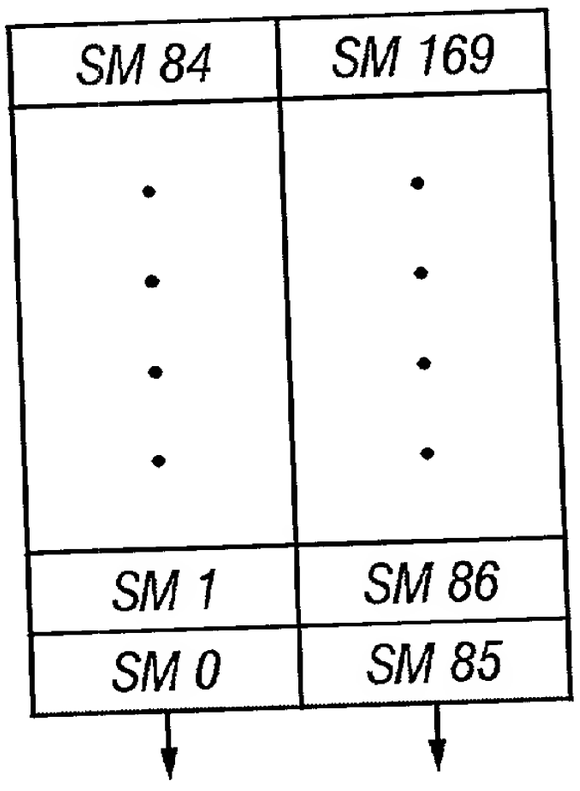
SM 84
SM 169
SM 1
SM 86
SM 0
SM 85

FIG. 10

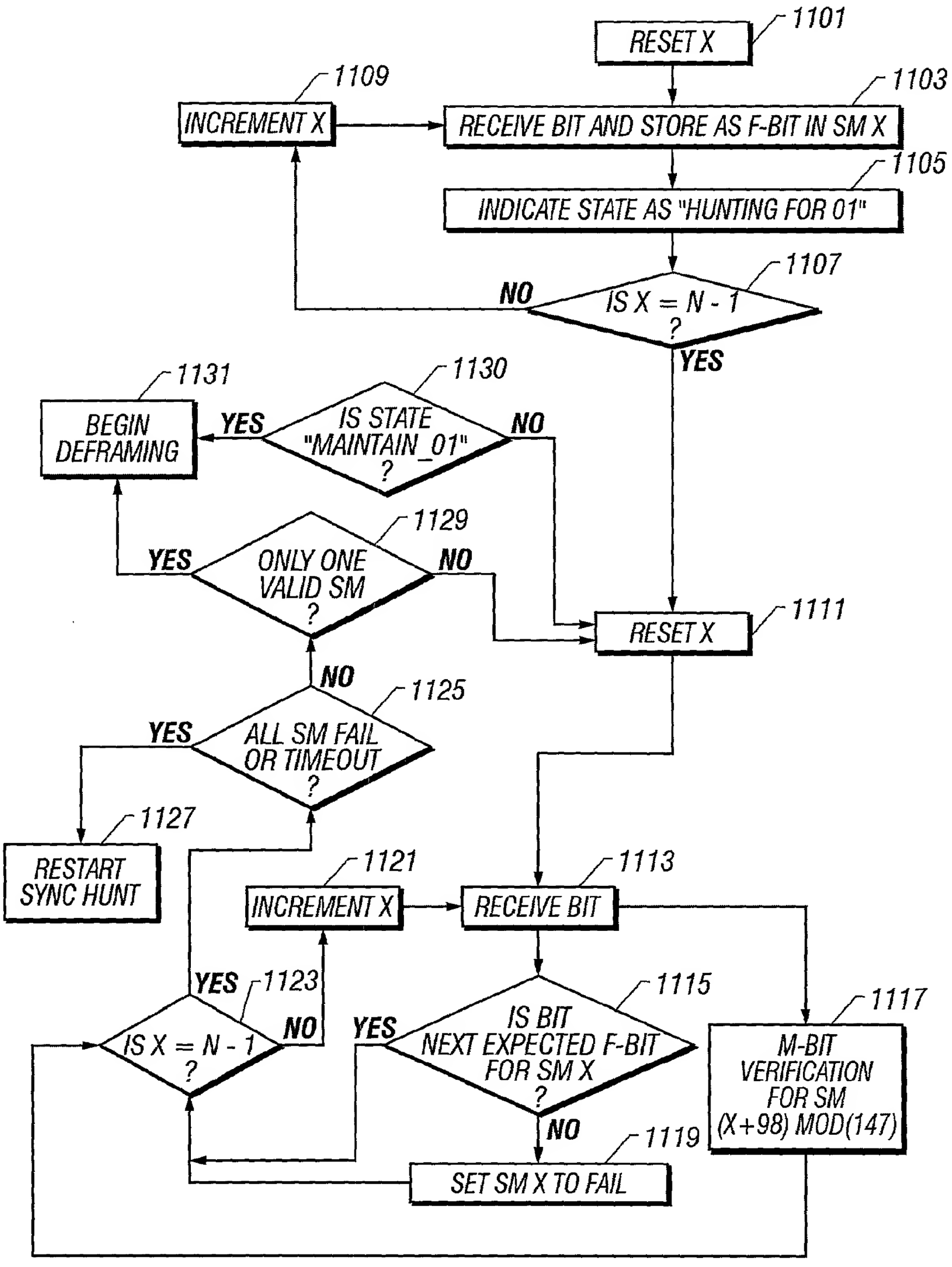
RESET X
1101
INCREMENT X
1109
RECEIVE BIT AND STORE AS F-BIT IN SM X
1103
INDICATE STATE AS "HUNTING FOR 01"
1105
IS X = N - 1 ?
1107
NO
YES
BEGIN DEFRAMING
1131
IS STATE "MAINTAIN_01" ?
1130
YES
NO
ONLY ONE VALID SM ?
1129
YES
NO
RESET X
1111
ALL SM FAIL OR TIMEOUT ?
1125
NO
YES
RESTART SYNC HUNT
1127
INCREMENT X
1121
RECEIVE BIT
1113
IS X = N - 1 ?
1123
YES
NO
IS BIT NEXT EXPECTED F-BIT FOR SM X ?
1115
YES
NO
M-BIT VERIFICATION FOR SM (X+98) MOD(147)
1117
SET SM X TO FAIL
1119

FIG. 11A

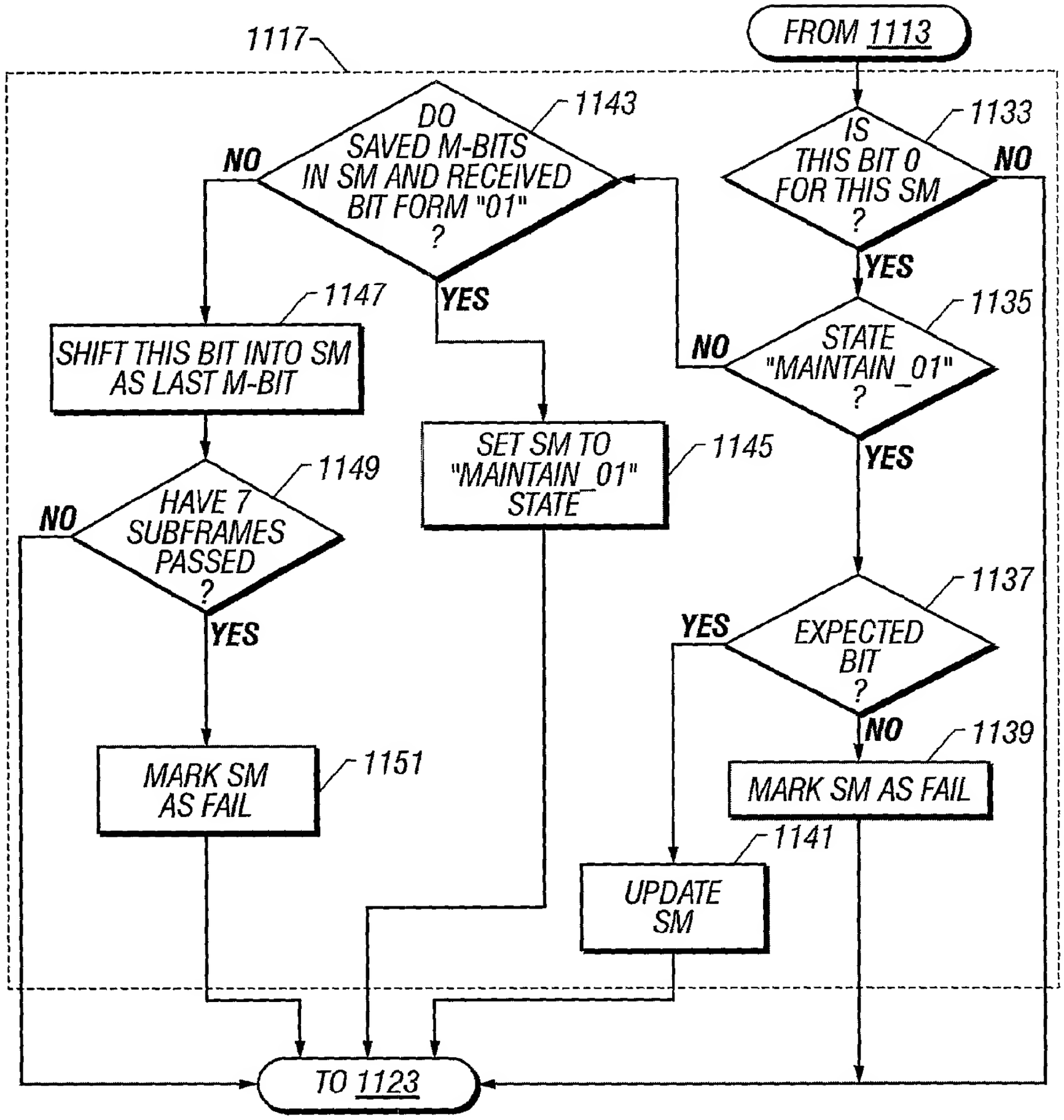
1117
FROM 1113
1143
DO SAVED M-BITS IN SM AND RECEIVED BIT FORM "01" ?
NO
YES
1133
IS THIS BIT 0 FOR THIS SM ?
NO
YES
1147
SHIFT THIS BIT INTO SM AS LAST M-BIT
1135
STATE "MAINTAIN_01" ?
NO
YES
1145
SET SM TO "MAINTAIN_01" STATE
1149
HAVE 7 SUBFRAMES PASSED ?
NO
YES
1137
EXPECTED BIT ?
YES
NO
1139
MARK SM AS FAIL
1151
MARK SM AS FAIL
1141
UPDATE SM
TO 1123

FIG. 11B

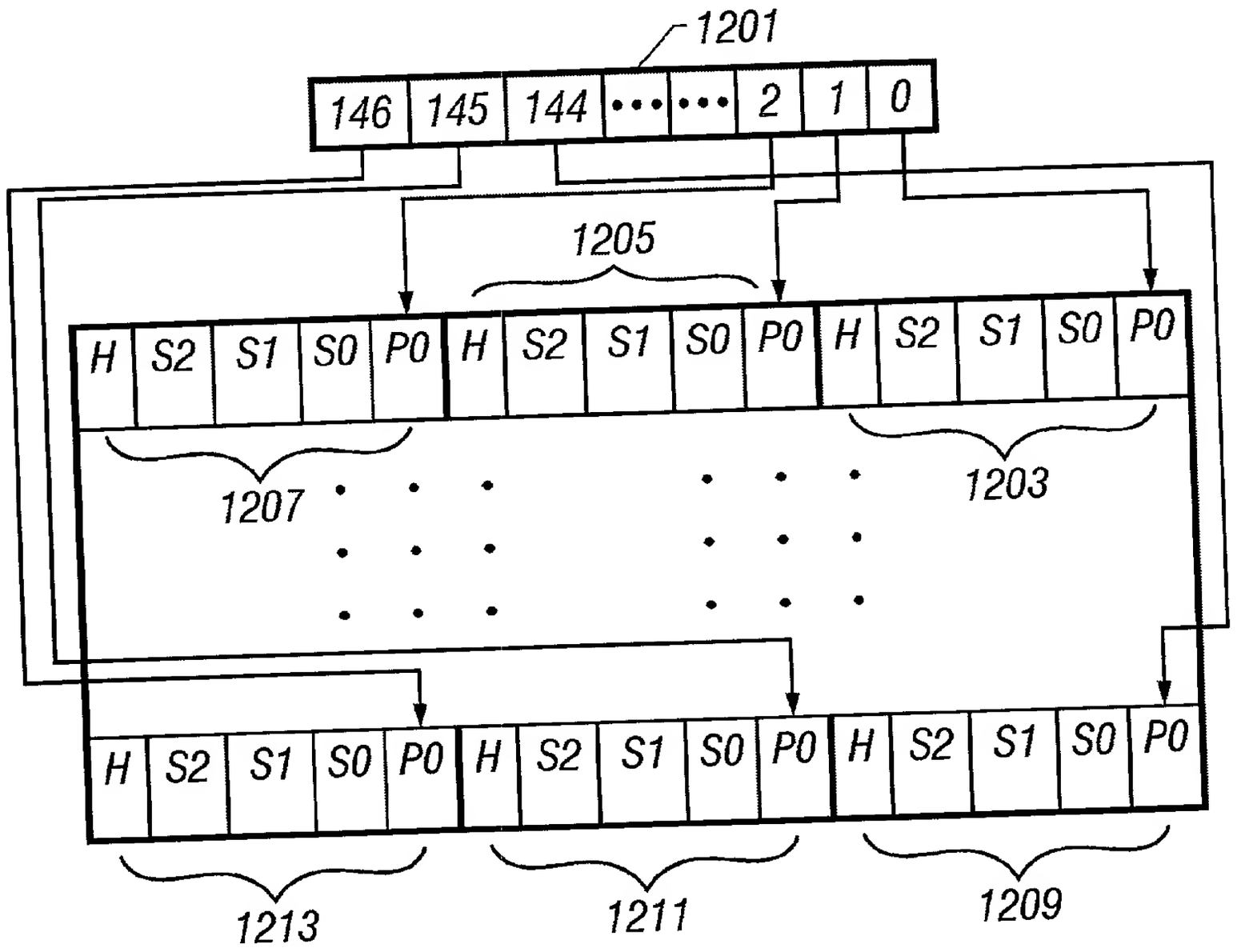
1201
146
145
144
2
1
0
1205
H
S2
S1
S0
P0
1207
1203
1213
1211
1209

FIG. 12

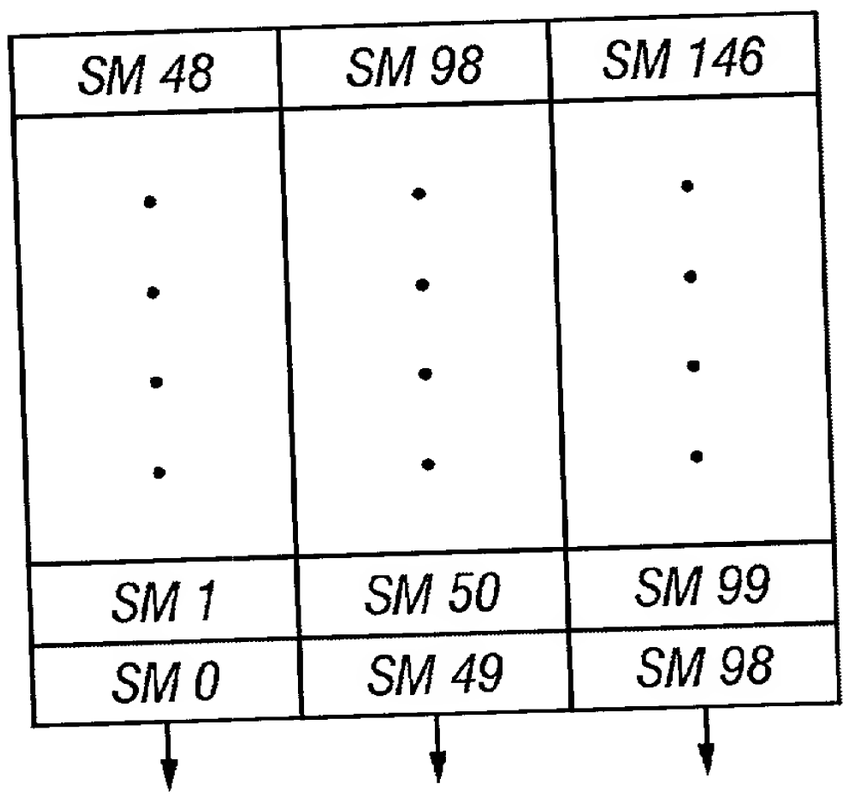
SM 48
SM 98
SM 146
SM 1
SM 50
SM 99
SM 0
SM 49
SM 98

FIG. 13

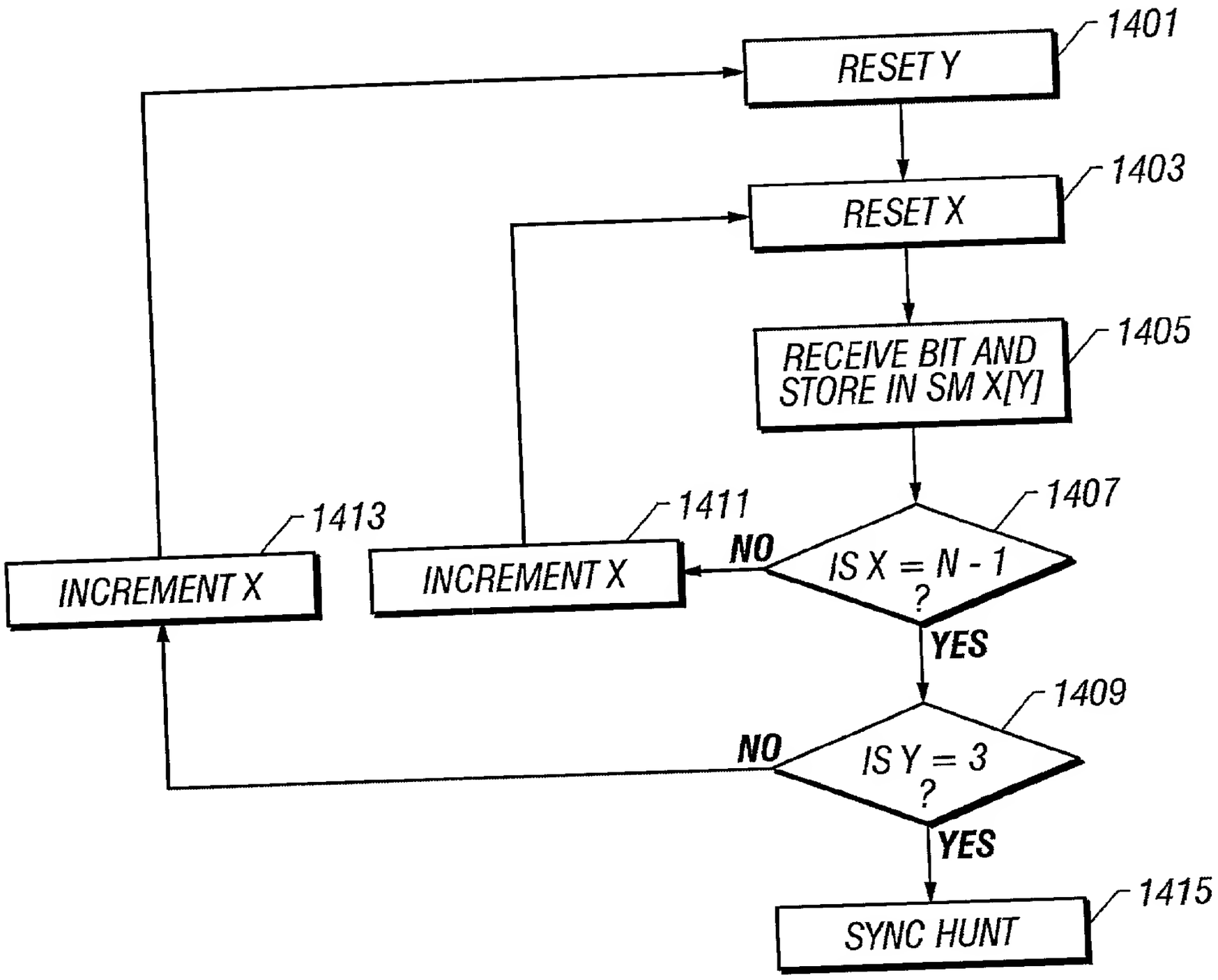
RESET Y
1401
RESET X
1403
RECEIVE BIT AND STORE IN SM X[Y]
1405
IS X = N - 1 ?
1407
NO
YES
IS Y = 3 ?
1409
NO
YES
INCREMENT X
1411
INCREMENT X
1413
SYNC HUNT
1415

FIG. 14A

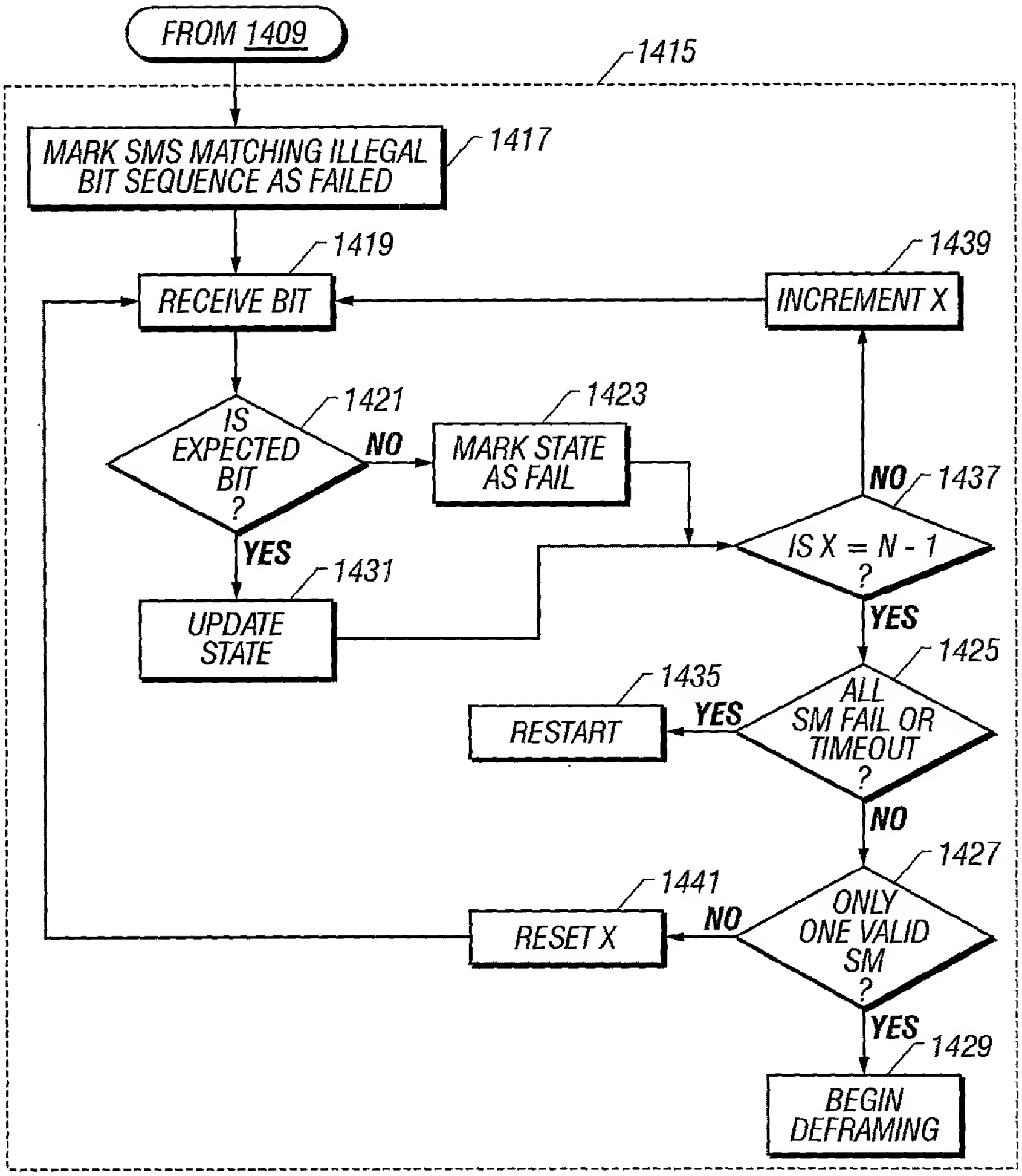
FROM 1409
1415
MARK SMS MATCHING ILLEGAL BIT SEQUENCE AS FAILED
1417
1419
RECEIVE BIT
1421
IS EXPECTED BIT ?
NO
1423
MARK STATE AS FAIL
YES
1431
UPDATE STATE
1439
INCREMENT X
NO
1437
IS X = N - 1 ?
YES
1425
ALL SM FAIL OR TIMEOUT ?
YES
1435
RESTART
NO
1427
ONLY ONE VALID SM ?
NO
1441
RESET X
YES
1429
BEGIN DEFRAMING

FIG. 14B

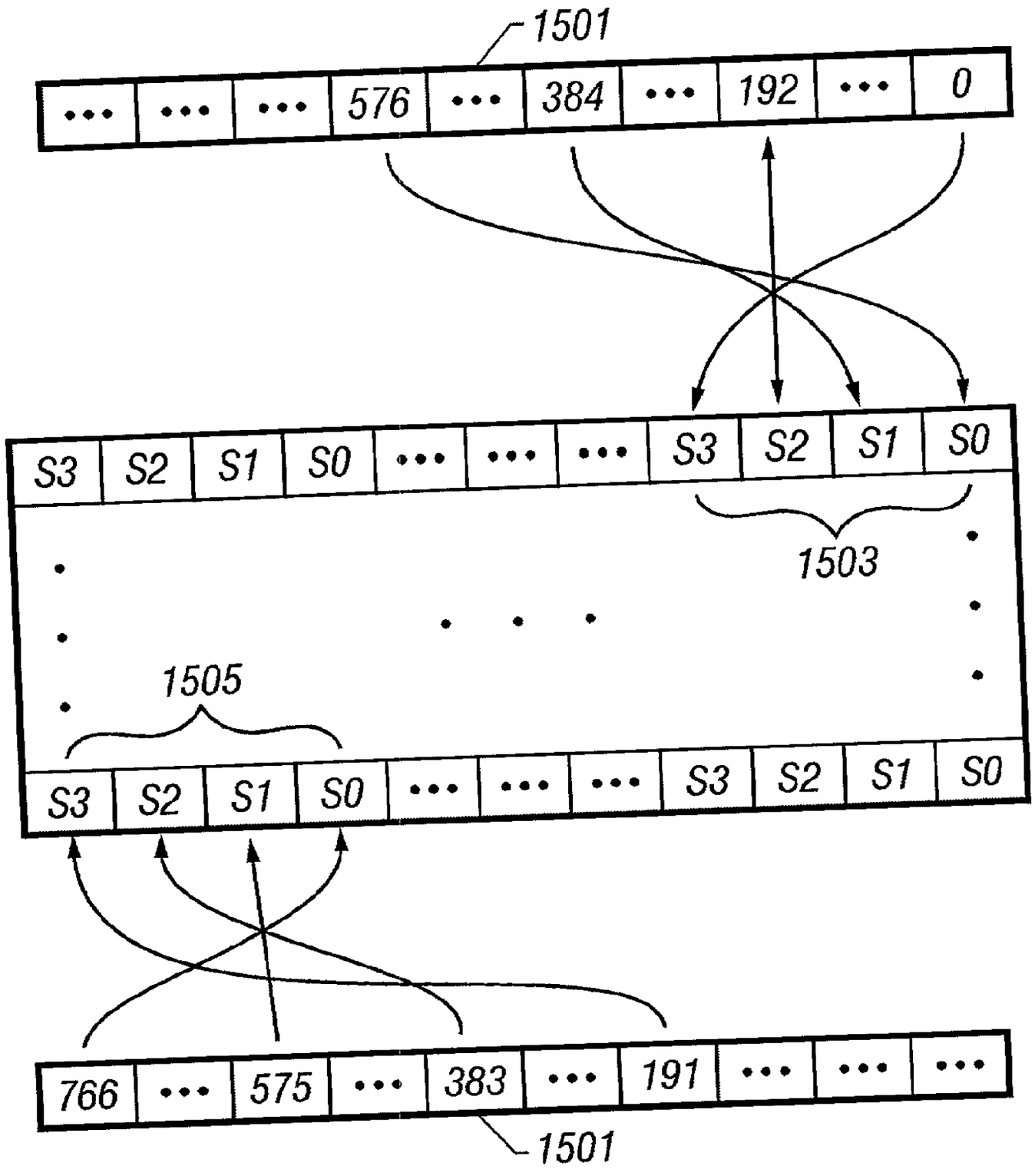

FIG. 15

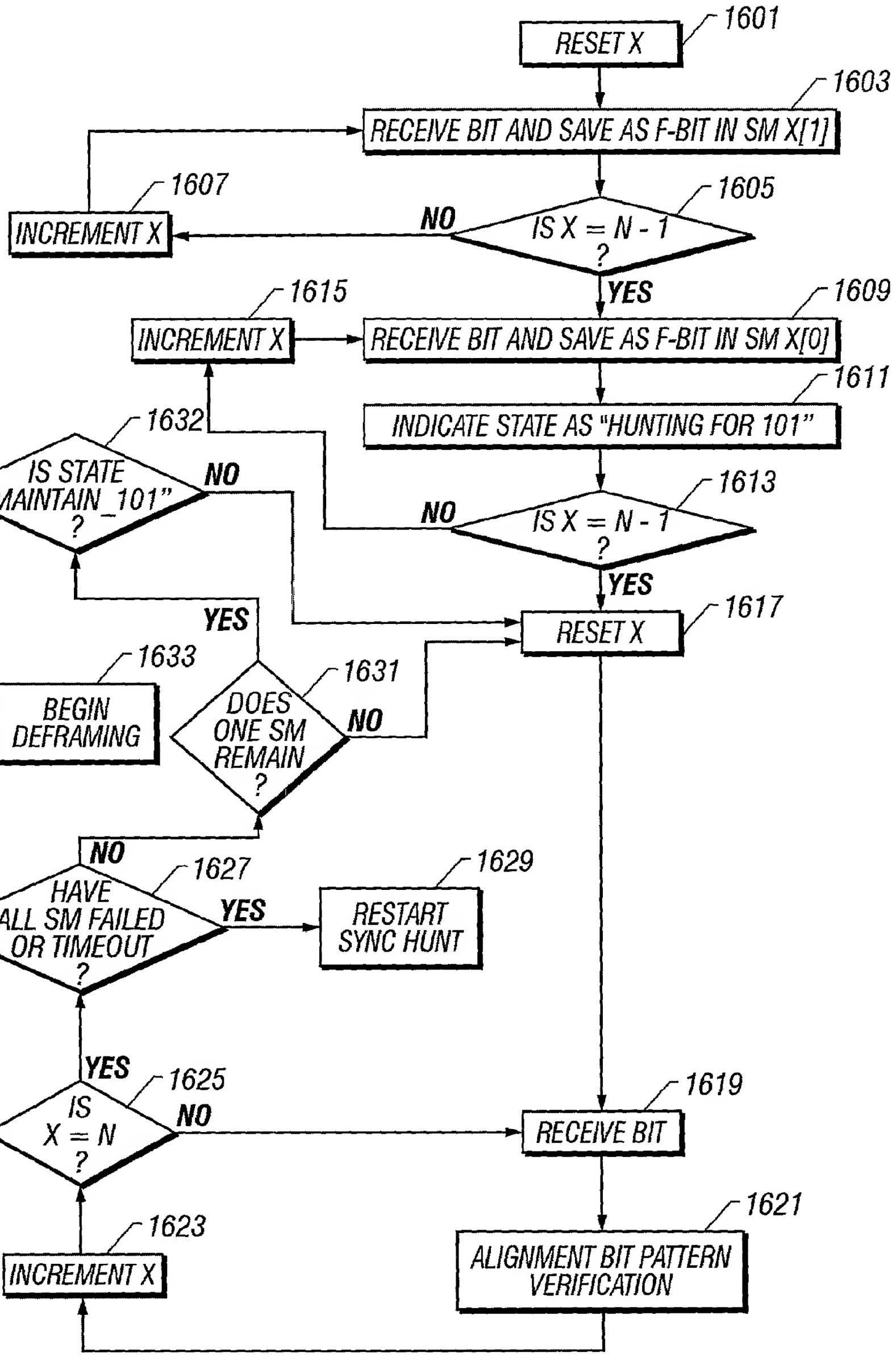
RESET X
1601
RECEIVE BIT AND SAVE AS F-BIT IN SM X[1]
1603
IS X = N - 1 ?
1605
NO
INCREMENT X
1607
YES
RECEIVE BIT AND SAVE AS F-BIT IN SM X[0]
1609
INCREMENT X
1615
INDICATE STATE AS "HUNTING FOR 101"
1611
IS X = N - 1 ?
1613
NO
YES
RESET X
1617
IS STATE "MAINTAIN_101" ?
1632
YES
NO
DOES ONE SM REMAIN ?
1631
NO
YES
BEGIN DEFRAMING
1633
HAVE ALL SM FAILED OR TIMEOUT ?
1627
NO
YES
RESTART SYNC HUNT
1629
IS X = N ?
1625
YES
NO
INCREMENT X
1623
RECEIVE BIT
1619
ALIGNMENT BIT PATTERN VERIFICATION
1621

FIG. 16A

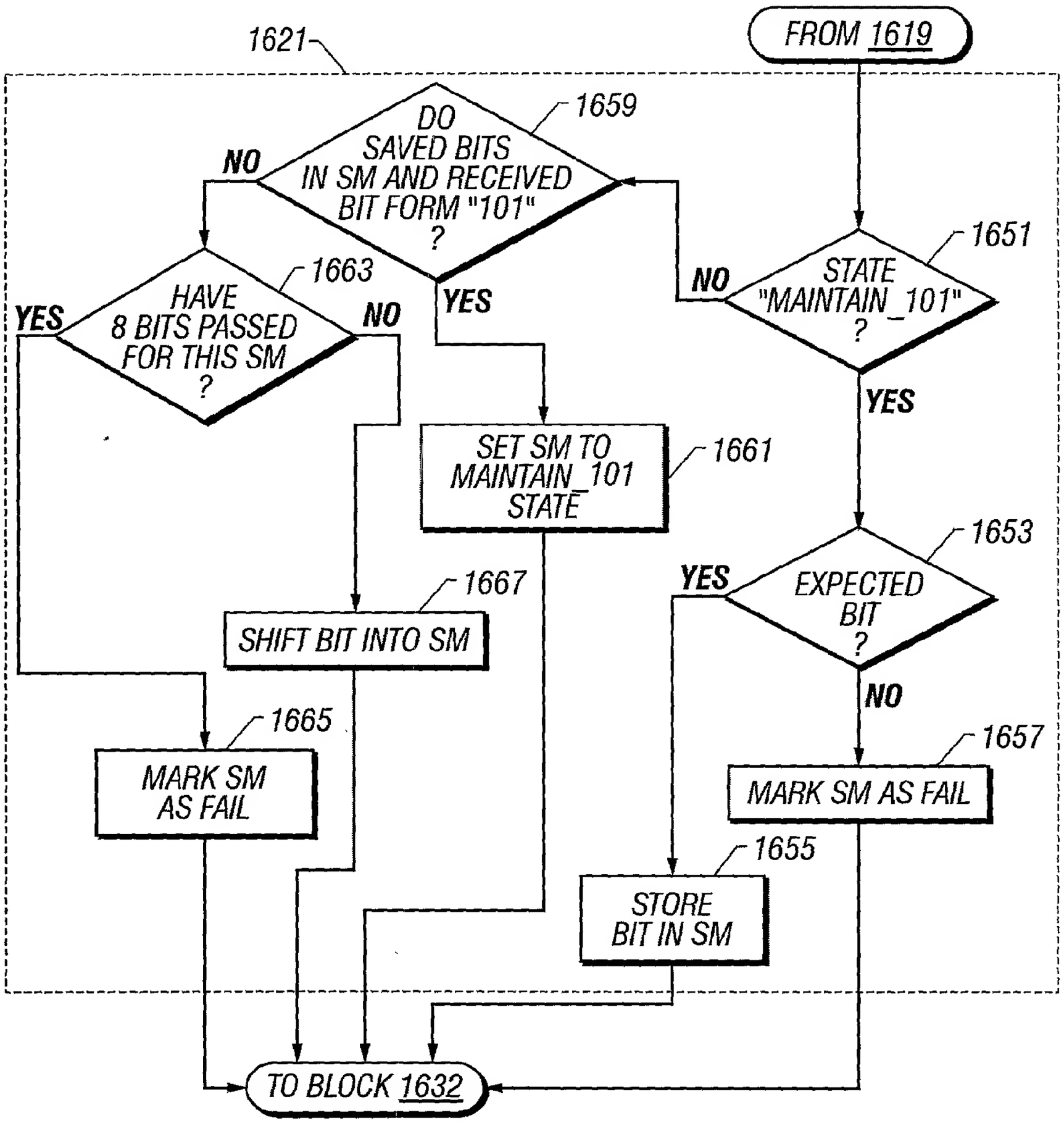
FROM 1619
1621
1659
DO SAVED BITS IN SM AND RECEIVED BIT FORM "101" ?
NO
YES
1651
STATE "MAINTAIN_101" ?
NO
YES
1663
HAVE 8 BITS PASSED FOR THIS SM ?
YES
NO
SET SM TO MAINTAIN_101 STATE
1661
1653
EXPECTED BIT ?
YES
NO
1667
SHIFT BIT INTO SM
1665
MARK SM AS FAIL
1657
MARK SM AS FAIL
1655
STORE BIT IN SM
TO BLOCK 1632

FIG. 16B

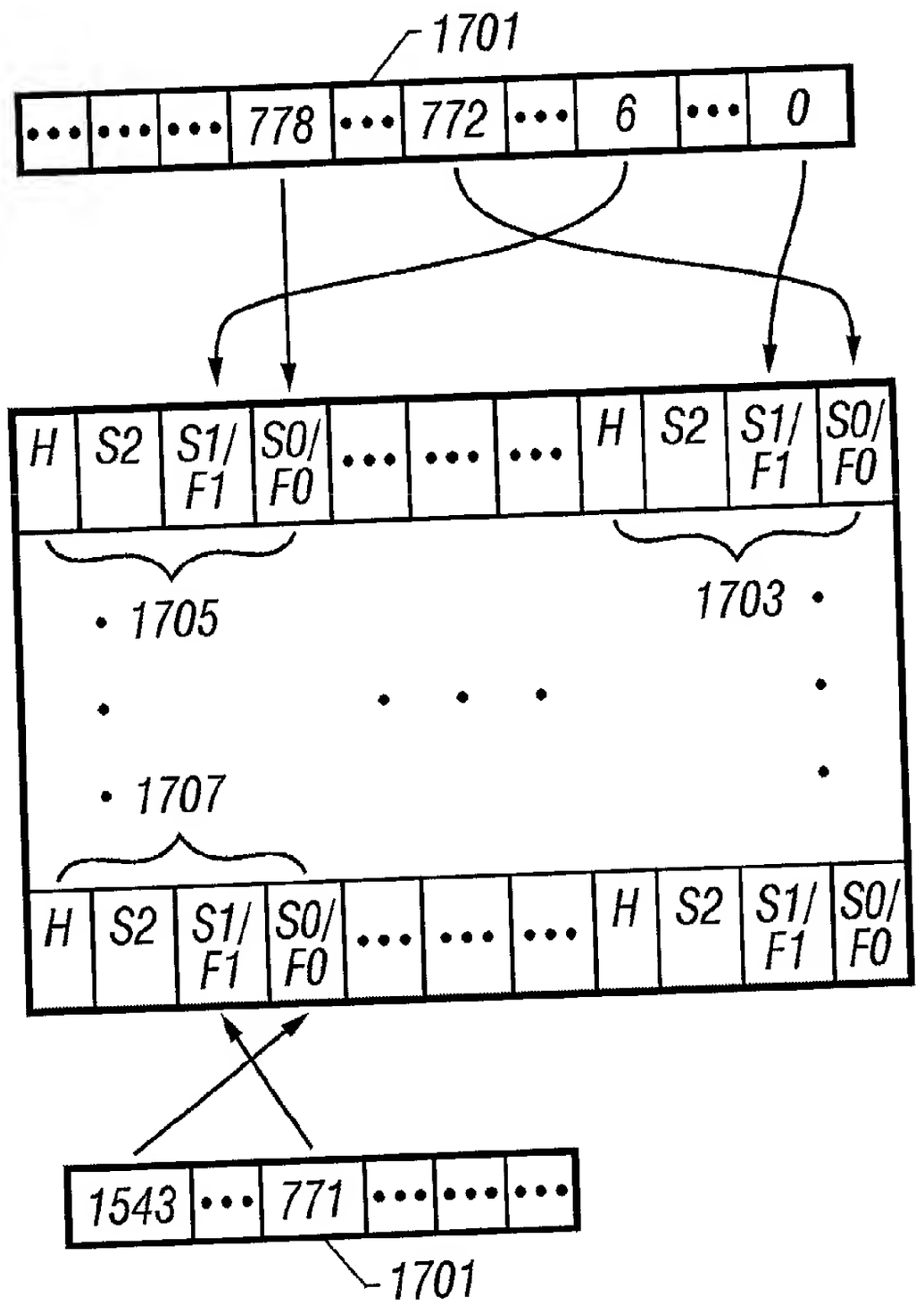
1701
778
772
6
0
H
S2
S1/ F1
S0/ F0
1705
1703
1707
1543
771
1701

FIG. 17

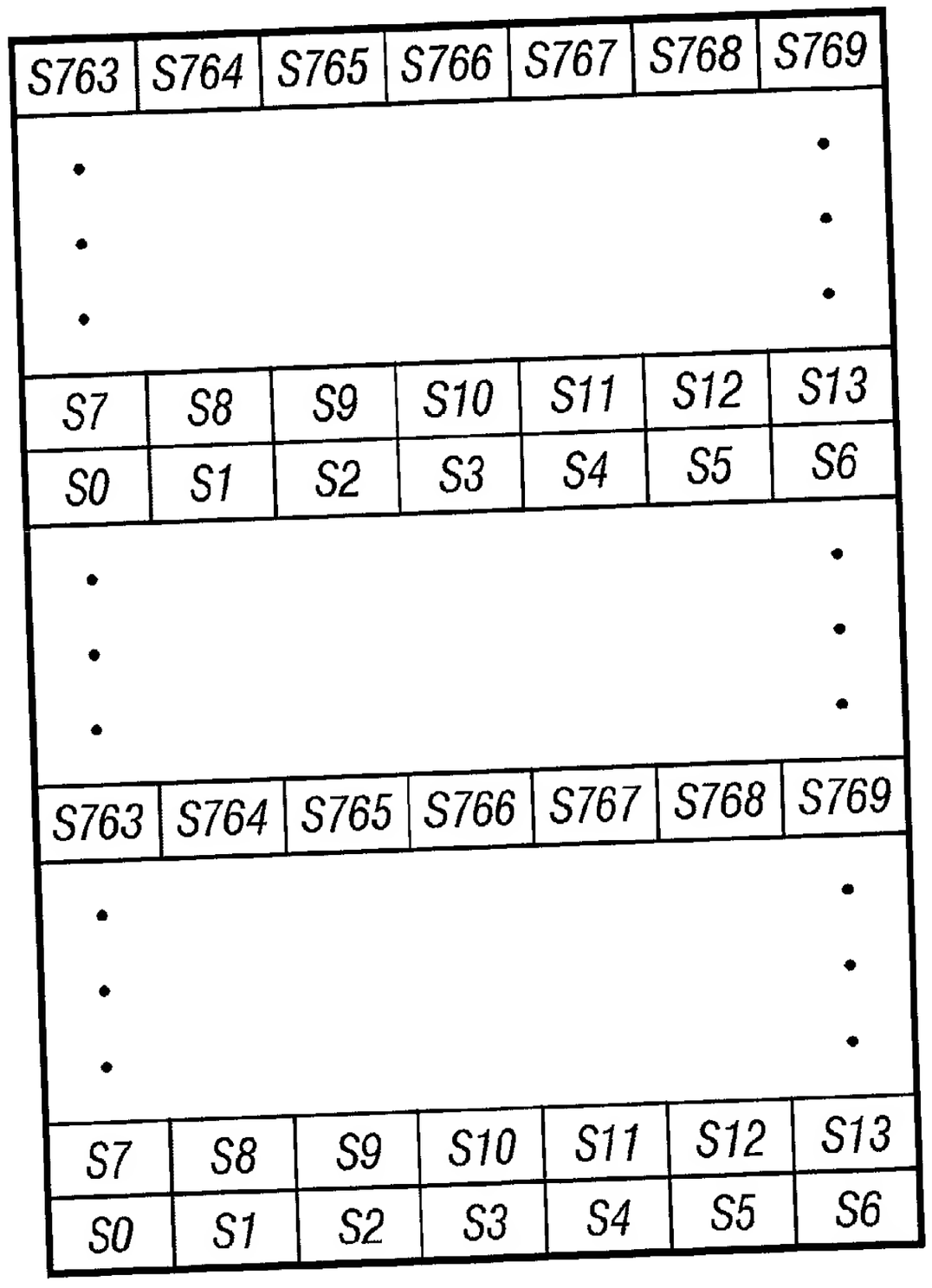
S763
S764
S765
S766
S767
S768
S769
S7
S8
S9
S10
S11
S12
S13
S0
S1
S2
S3
S4
S5
S6

FIG. 18

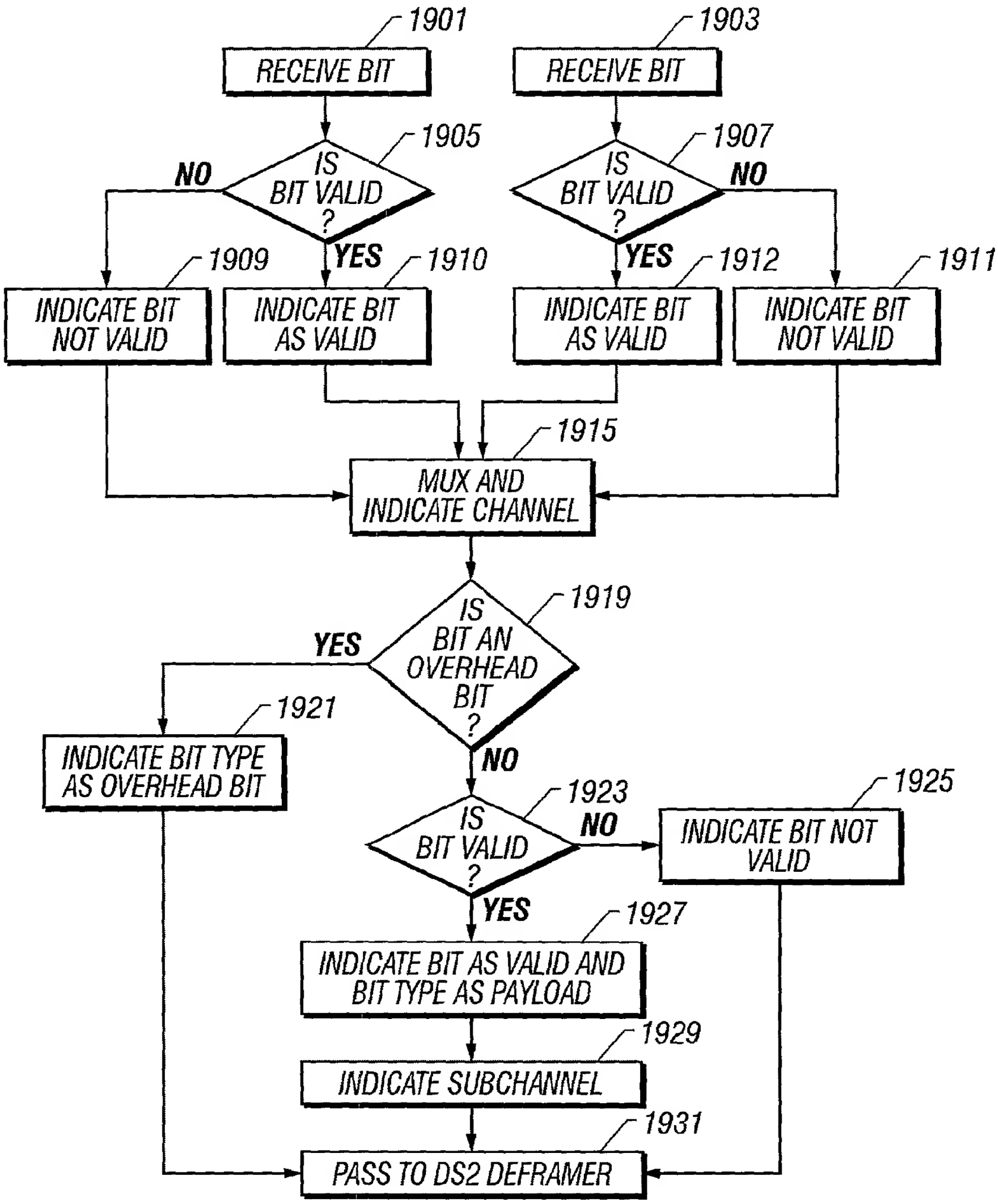
1901
RECEIVE BIT
1903
RECEIVE BIT
1905
IS BIT VALID ?
NO
YES
1907
IS BIT VALID ?
NO
YES
1909
INDICATE BIT NOT VALID
1910
INDICATE BIT AS VALID
1912
INDICATE BIT AS VALID
1911
INDICATE BIT NOT VALID
1915
MUX AND INDICATE CHANNEL
1919
IS BIT AN OVERHEAD BIT ?
YES
NO
1921
INDICATE BIT TYPE AS OVERHEAD BIT
1923
IS BIT VALID ?
NO
YES
1925
INDICATE BIT NOT VALID
1927
INDICATE BIT AS VALID AND BIT TYPE AS PAYLOAD
1929
INDICATE SUBCHANNEL
1931
PASS TO DS2 DEFRAMER

FIG. 19

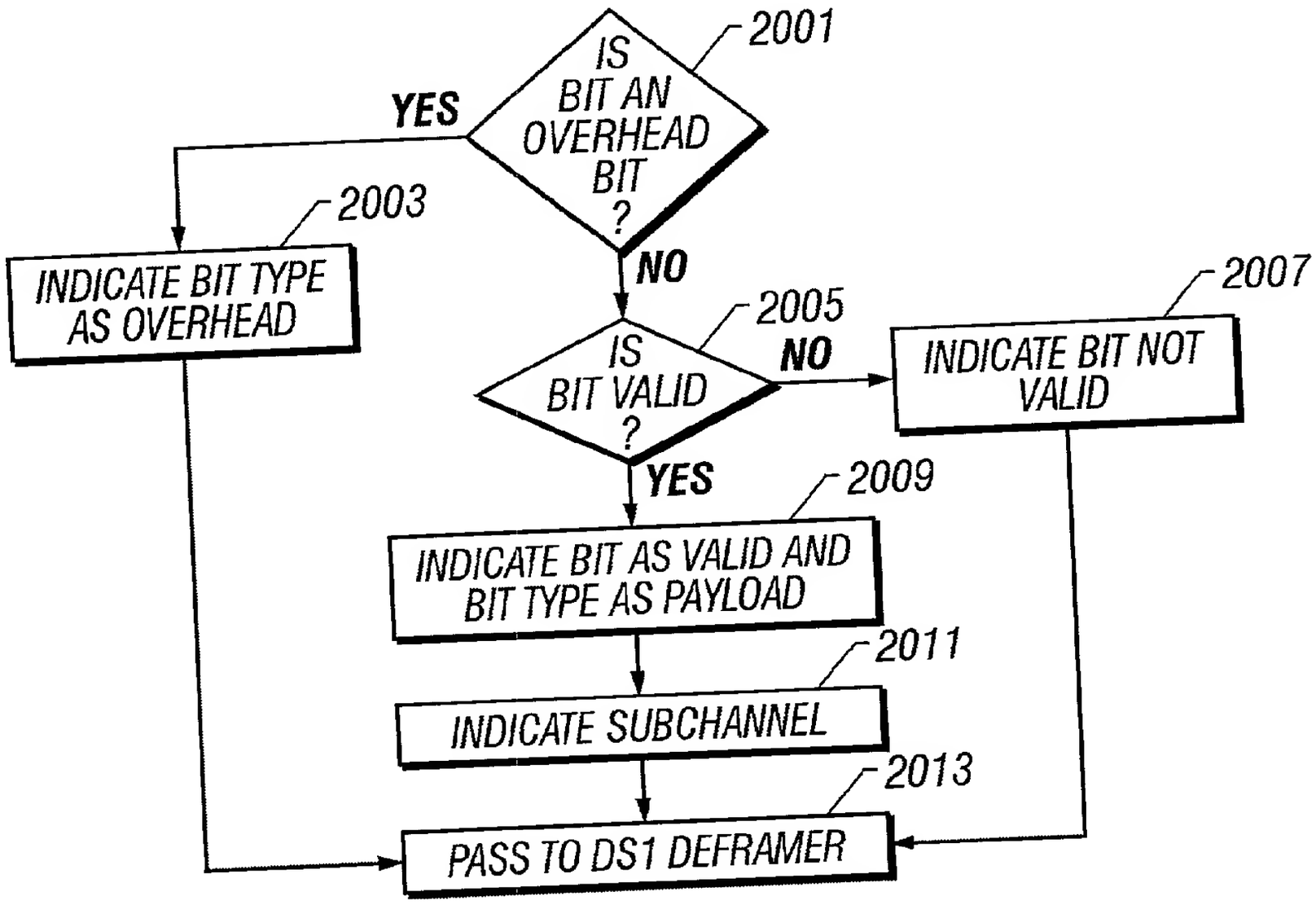
IS BIT AN OVERHEAD BIT ?
2001
YES
NO
INDICATE BIT TYPE AS OVERHEAD
2003
IS BIT VALID ?
2005
NO
INDICATE BIT NOT VALID
2007
YES
INDICATE BIT AS VALID AND BIT TYPE AS PAYLOAD
2009
INDICATE SUBCHANNEL
2011
PASS TO DS1 DEFRAMER
2013

FIG. 20

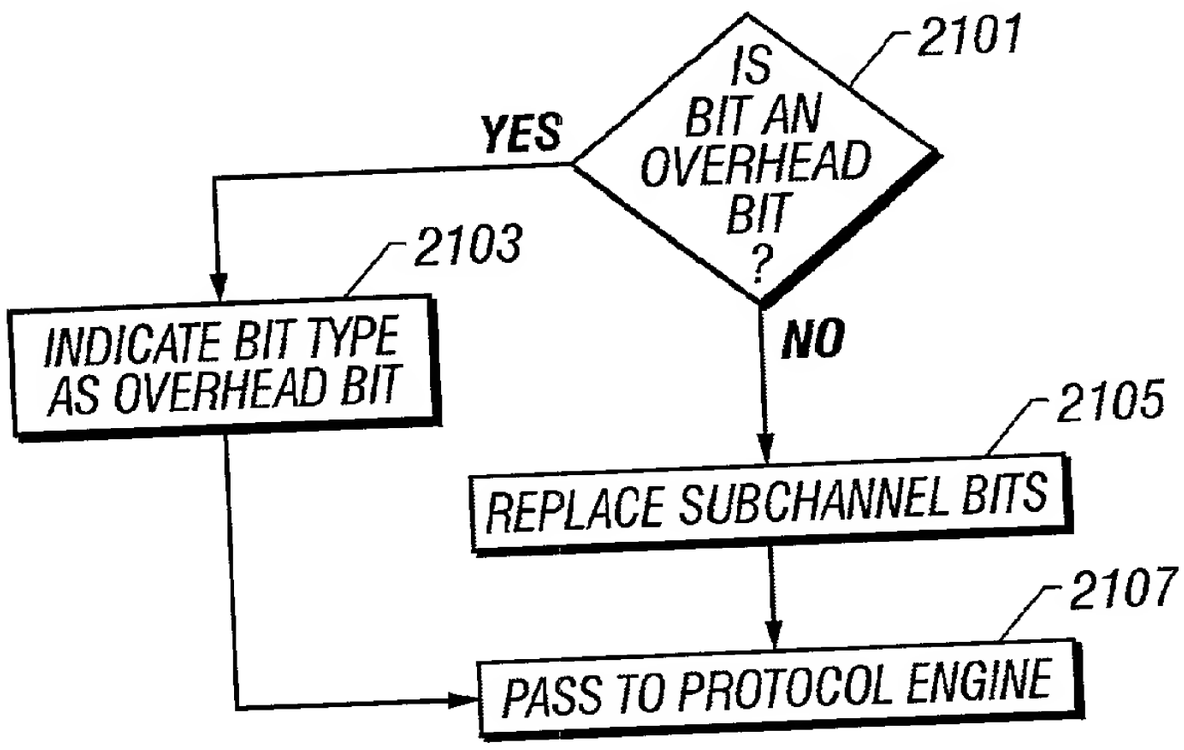
IS BIT AN OVERHEAD BIT ?
2101
YES
NO
INDICATE BIT TYPE AS OVERHEAD BIT
2103
REPLACE SUBCHANNEL BITS
2105
PASS TO PROTOCOL ENGINE
2107

FIG. 21

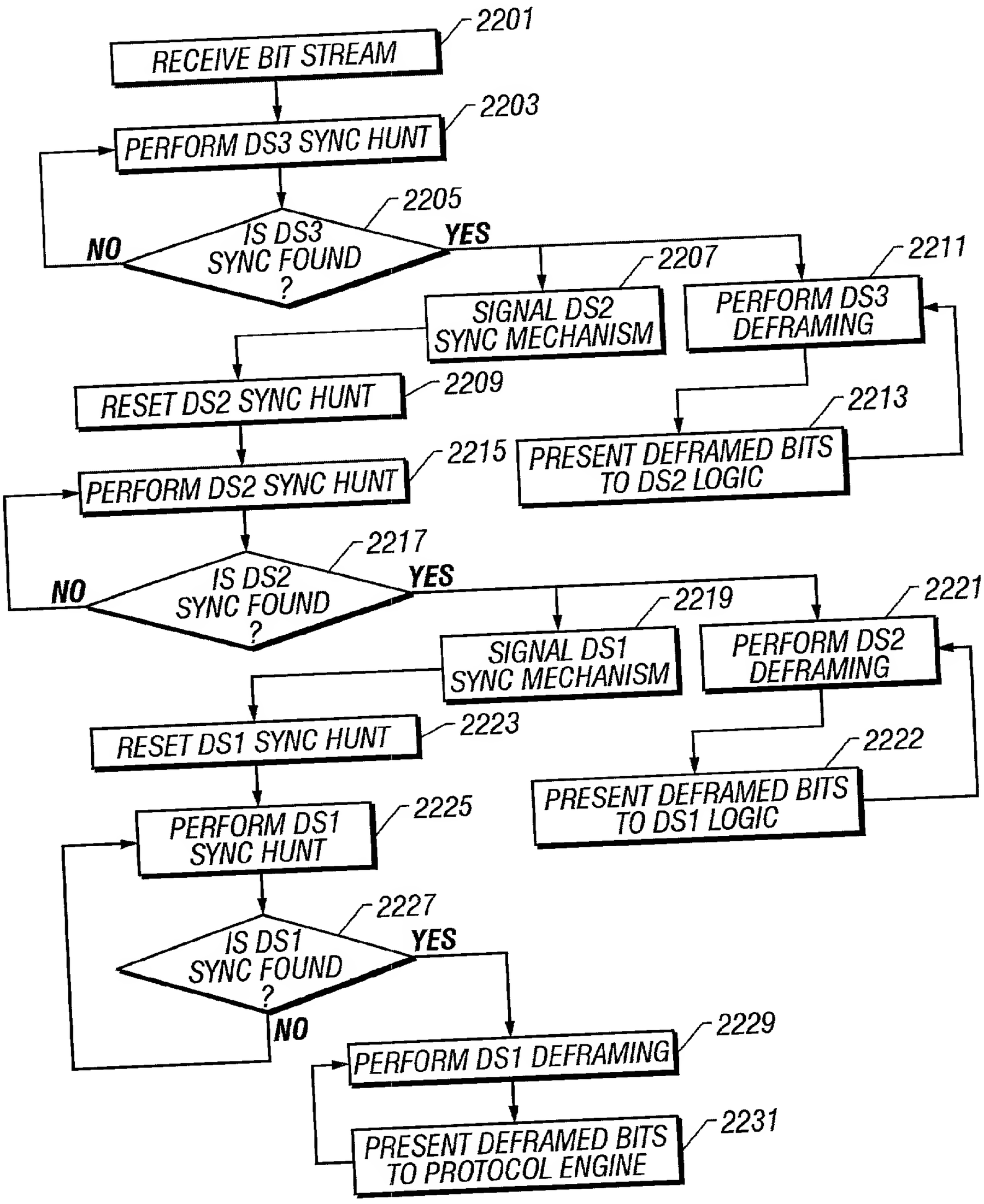
2201
RECEIVE BIT STREAM
2203
PERFORM DS3 SYNC HUNT
2205
IS DS3 SYNC FOUND ?
NO
YES
2207
SIGNAL DS2 SYNC MECHANISM
2211
PERFORM DS3 DEFRAMING
2209
RESET DS2 SYNC HUNT
2213
PRESENT DEFRAMED BITS TO DS2 LOGIC
2215
PERFORM DS2 SYNC HUNT
2217
IS DS2 SYNC FOUND ?
NO
YES
2219
SIGNAL DS1 SYNC MECHANISM
2221
PERFORM DS2 DEFRAMING
2223
RESET DS1 SYNC HUNT
2222
PRESENT DEFRAMED BITS TO DS1 LOGIC
2225
PERFORM DS1 SYNC HUNT
2227
IS DS1 SYNC FOUND ?
YES
NO
2229
PERFORM DS1 DEFRAMING
2231
PRESENT DEFRAMED BITS TO PROTOCOL ENGINE

FIG. 22